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Separating content and structure in humor appreciation: The need for a bimodal model and support from research into aesthetics

Ruch, Willibald ; Platt, Tracey

Abstract: For a long time humor theorists have acknowledged that content and structure of humor (or: joke work vs. tendency, [4]; thematic vs. schematic, [12]; cognitive vs. orectic factors, [3]) have to be distinguished as two different sources of pleasure [6]. Nevertheless, against all evidence, taxonomies of humor are stuck in (serial) unimodal classifications rather than bi- or multimodal models. Intuitive classifications of humor typically distinguish between content classes (e.g., blonde jokes, dead baby jokes, Stalin jokes), neglecting the contributions of structural properties to appreciation of humor. Also rational taxonomies most frequently emphasize content features; e.g., when emotional features like disgust, fear or anger are highlighted in humor.

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Book Section

Originally published at:

Ruch, Willibald; Platt, Tracey (2012). Separating content and structure in humor appreciation: The need for a bimodal model and support from research into aesthetics. In: Nijholt, Anton. Computational humor 2012: extended abstracts of the (3rd international) workshop on computational humor. Enschede: Centre for Telematics and Information Technology <Enschede>, 23-28.

Computational Humor 2012

EXTENDED ABSTRACTS OF THE (3rd INTERNATIONAL)
WORKSHOP ON COMPUTATIONAL HUMOR

Amsterdam, June 8, 2012

Anton Nijholt (ed.)

CIP GEGEVENS KONINKLIJKE BIBLIOTHEEK, DEN HAAG

Nijholt, A.

Computational Humor 2012

Proceeding of 3rd International Workshop on Computational Humor

A. Nijholt (ed.)

Amsterdam, Universiteit Twente, Faculteit Elektrotechniek, Wiskunde en Informatica

ISSN 0929-0672

CTIT Workshop Proceedings Series WP12-02

Keywords: humor, humor models, humor theory, humor generation, corpora, jokes, semantics
ontologies, natural language processing

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Preface to Computational Humor 2012

Like its predecessors in 1996 (University of Twente, the Netherlands) and 2002 (ITC-irst, Trento, Italy), this Third International Workshop on Computational Humor (IWCH 2012) focusses on the possibility to find algorithms that allow understanding and generation of humor. There is the general aim of modeling humor, and if we can do that, it will provide us with lots of information about our cognitive abilities in general, such as reasoning, remembering, understanding situations, and understanding conversational partners. But it also provides us with information about being creative, making associations, storytelling and language use. Many more subtleties in face-to-face and multiparty interaction can be added, such as using humor to persuade and dominate, to soften or avoid a face threatening act, to ease a tense situation or to establish a friendly or romantic relationship. One issue to consider is: when is a humorous act appropriate?

This 2012 workshop is different from previous workshops [1,2]. The 1st and 2nd workshop on computational humor aimed at providing an opportunity to present scientific results on modelling humor, where modelling needs to be done in order to be able to understand humor and to generate humor in a context of human-computer interaction.

The first workshop [1], organized at the University of Twente in September 1996, was an opportunity to listen to researchers and publicists such as Marvin Minsky, Douglas Hofstadter, and John Allen Paulos. This event, sponsored by many companies and research funding organizations in the Netherlands, consisted of a large public event introducing humor research to the general (academic) public, a student competition on writing vision papers on humor and information and communication technology, and, of course, the workshop itself, with plenary sessions in which research was presented on modelling humor and humor applications, in particular verbal humor. A more focused meeting on detecting and interpreting humorous texts was also part of this 1996 event.

The second workshop [2], organized at ITC-IRST, Trento, Italy, in April 2002, broadened the view to non-verbal humor (e.g., humor expressed by embodied agents), humor and psychology, emotion research, and applications of humor research. Douglas Hofstadter and Anthony Ortony took part in presentations and panel discussions. Applications, including non-verbal humor, e.g., to be used by embodied conversational agents, were emphasized during this workshop. This particular workshop took place in the context of a ‘modest’ European funded project on computational humor, the so-called HAHAcronym project. The proceedings of this workshop mentioned: “... humour is something we need for our survival. For surviving with computers they will have to demonstrate some humour capability themselves.” An influential paper on Computational Humor appeared in IEEE Intelligent Systems in 2006 [3].

As mentioned, this third workshop on computational humor is different from previous ones. Rather than having a large-scale event and having the opportunity to present research results to colleagues and a general audience, we decided to have an event where a small number of (invited) humor researchers could reflect on the state of the art of humor research and develop visions on future computational humor research. Clearly, this workshop and the presentations take into account new developments in information and computing technologies (ICT) that allow detecting and interpreting humor and that allow generation and display of humor.

Hence, in this workshop there is emphasis on an active role of the computer in interpreting and generating humor. But other, supporting approaches are considered as well. These approaches can vary from Cognitive Science to Social Psychology and from Communication Science to Human-Computer Interaction. Although humor researchers have been aware that a multi-disciplinary approach to humor modeling was needed, there has not always been sufficient research interest from other research communities that have been struggling to establish their own domain and research methodology. But, recognizing the importance of humor in human-human interaction and also recognizing that in many situations human-human interaction will be replaced by human-computer interaction has emphasized the need to investigate and model the role of humor in daily life interactions and activities.

In addition, and maybe even more importantly, in the last decade we have also seen the emergence of pervasive computing, ambient intelligence, and the ‘Network of Things’. From a humor research point of view advantage can be taken of the possibility that sensor-equipped environments, where the sensors

are intelligent, are connected and are supported by coordinating computer power, to know and learn about the user, his or her history and background, and the contexts a user is referring to when addressing the environment, particular applications, or other users. Reactive behavior in direct contact with a user, and pro-active behavior because of anticipated activities and preferences of a user become possible. Reactive and pro-active humor interpretation and generation then need to be considered. Nonverbal behavior can be detected and needs to be interpreted to serve as input for understanding humorous acts and for generating, in an appropriate way, humorous acts. So, sensor-equipped environments allow us to understand more of the user, including his or her wish to use humor and to choose a particular form of expression of humor. But there is also the question of how the environment provides feedback to (multimodal) humor expressions that it can understand (or not) and when and how the environment decides to display its created humorous act. Although not directly to humor applications, there are many human-computer applications that look at technology provided by Microsoft's Kinect, natural language processing by SRI, and translation by Google Translate. Far from being perfect, we should understand that such applications can be beneficial for humor research.

Hence, from a 2012 research point of view, there are the following topics of interest when considering computational humor research:

Topics of interest for the workshop include:

- Modeling verbal and nonverbal humor
- Recognizing and generating humor
- Embodied agents, social robots and humor
- Appropriateness of humor generation
- Nonverbal speech, facial expressions, and humor recognition
- Sentiment analysis and humor
- Humor corpora
- Applications of humor research

These topics will be addressed by the invited speakers for this workshop:

- Christian F. Hempelmann, Purdue University, West Lafayette, IN, USA.
- Rada Mihalcea, University of North Texas, Denton, TX, USA.
- Victor Raskin, Purdue University, West Lafayette, IN, USA.
- Willibald Ruch, Department of Psychology, University of Zurich, Switzerland.
- Oliviero Stock, IRST, Fondazione Bruno Kessler, Povo, Trento, Italy.
- Carlo Strapparava, IRST, Fondazione Bruno Kessler, Povo, Trento, Italy.
- Julia Taylor, Purdue University, West Lafayette, IN, US.
- Alessandro Valitutti, Department of Computer Science, University of Helsinki, Finland.



Workshop Venue

The Computational Humor 2012 workshop took place in Amsterdam, the Netherlands on June 8, 2012. The workshop was held in the Trippenhuis, a historical building which is the home of the Royal Academy of Sciences in the Netherlands. It is beautifully located in the old center of Amsterdam.

Acknowledgements

We are grateful to the Human Media Interaction group of the University of Twente for making it possible to organize this workshop. Thanks go also to the CTIT research institute of the University of Twente for making these proceedings possible. This workshop is organized by the University of Twente node as part of its activities of the CaSA (Computers as Social Actors) project of the EIT ICT Labs. We are thankful for the financial support provided by CaSA. A special word of thanks goes to Hendri Hondorp who took on the role of technical editor of these proceedings.

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Anton Nijholt

Enschede, June 2012

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Papers

False Logic, Formally?

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Most humor theories agree that, together with the main concept of incongruity, a component of playful, incomplete resolution of this incongruity is an essential part of humor. This assumption can be found expressed as early as Sarbiewski (1619/1623) [13] and in more appreciable detail in Aubouin’s [4] notion of a “acceptation-justification,” the momentary acceptance of the incongruity of humor enabled by its superficial justification. This mechanism has been discussed extensively in the contributions of [9, 10] where he develops the concept of the appropriateness of humorous incongruity. In the heyday of psychological humor research, several theories addressed resolution as a key stage in humor processing (e.g., [15, 14, 12]).

As in humor research in general, incongruity, or script oppositeness, has received the most attention in linguistic and linguistics-based computational approaches to humor. But systematic, detailed, and formal work on the more elusive issue of resolution has been carried out in the context of the General Theory of Verbal Humor (GTVH; [3] under the knowledge resource “logical mechanism” (LM), in particular in Attardo [1, 2, 8]). The term has been adapted to “pseudo-logical mechanism” (pLM), because many researchers misunderstood the reasoning enabled by the LM to be valid reasoning, confused by the term “logical,” which can mean “pertaining to logic” as well as “valid in terms of [some type of] logic.” Importantly, the pseudo-logic of the resolution is only locally valid [16] and defeasible, never fully resolving the incongruity, but merely masking it.

As is well known, many computational humor generation systems use the punning pLM (cf. [5]) because, as I have argued, this pLM is easy to model with sound similarity or identity, while the underlying complex semantic effects can be largely ignored [6]. But for non-ad-hoc computational humor, in particular in humor understanding where input can’t be assumed to be restricted to puns alone, the full range of pLMs needs to be made available to computational humor systems. The present contribution is an attempt at imagining if and how this can take place, by highlighting the major problems, outlining the state of the art, and suggesting avenues for future work, some of which is already in process. Overall, as befits a contribution to a workshop, I hope to raise more questions than I will claim to answer.

One assumption, which if correct casts substantial doubt on the whole undertaking of formalizing humor, or at least pLMs (if they exist at all), needs to be taken seriously. It should subsequently be ignored so that progress in computational humor research can be made. This assumption, condensed into the title of this presentation, is that humor, in particular the false logic of the pLM, can’t be formalized to the degree that it becomes operationalizable computationally. I don’t mean this in the sense often encountered in the criticism of formal humor theories, namely, that formalization doesn’t leave any room for the human, creative, etc., aspects of humor. Nor is it meant in the sense of the famous E.B. White quote that “analyzing humor is like dissecting a frog. Few people are interested and the frog dies of it.” We are not dissecting humor in its computational processing, but rather trying to translate something pseudo-logical into languages that can’t allow for anything but normal logic. So humor won’t die, it just doesn’t translate with our methods.

What I mean is that we may well find the pLM to reside in the layer of meaning that natural language can afford to—or actually must—leave underspecified. This semantic underspecification gives NL versatility without which it can’t function in everyday meaning exchange. Making

specific what is underspecified in non-humorous, bona-fide text in computational processing can yield useful disambiguations and clarifications. In the case of humorous texts, it should yield two partially overlapping, but opposite interpretations of the text. However, retaining the necessary relationship between these interpretations, which is what the concept of pLM aims to capture, might in principle be impossible. In other words, this important part of humor is afforded the ability to hide in natural language in a way that can't be translated into a formal language. If this is the case, then humor is part of the attempted, incomplete symbol processing, not part of logic processing of the resulting disambiguated formal symbols and their relations. That is, the pLM is not a logical formula that can be represented in a fully formal language, but part of human natural language processing before it becomes formal, formalizable, and possibly prevented from ever becoming formalizable in principle.

Returning to a more optimistic engineering approach to the pLM (although the most optimism for computational humor researchers is usually achieved by ignoring pLMs altogether), in a recent (self-)reinvention of the GTVH, the Ontological-Semantic Theory of Humor (OSTH; [11]), a first approximation to a pLM-like effect has been described [7]. In the ongoing knowledge resource engineering and testing of an NLP system, it became apparent that the system consistently ranked certain interpretations of the meaning of sentences second that the engineers happened to consider humorous. It appeared that the interpretation that the system considered best and ranked first, in terms of fit to the semantic expectations that the system had, beat the second-ranking interpretation, because the latter was slightly deviant from those expectations, but not as much as interpretations that were ranked even lower. This slight deviation from the constraints based on the semantic interpretation seemed to be the degree of falseness corresponding to a possibly humorous reading.

The following example is the second-ranking automatically generated interpretation of the sentence "Meggett has been acquitted on sex-related charges."

```

acquit-v1, sentencing(factivity(value(0)))
  agent(value (unknown))
  beneficiary(PND (Meggett-n1, football-player
    on-top-of(sem (charge-n1, explosive-device)
      instrument-of(sem (sex-n1, sex-event)))))

```

A natural language paraphrase of the sentence interpretation should make the humorous potential apparent: A football player called Meggett was not sentenced for a crime that he was accused of, and this non-sentencing took place while he was located on top of an explosive device that is used for sex. The approximation of the pLM in operation here is merely the unspecified false matching of any of the many constraints used in generating the representation of the sentence's meaning.

Thus, there is obviously a lot of work to do, before at least more than a few incarnations of the pLM can be modeled sufficiently that the concept can be operationalized in computational humor systems. A principled engineering approach could proceed along the lines of the following assumption: "In general, partiality can be maintained at two levels. On the one hand, a fully normal logic may only apply partially to make the two scripts appear appropriate in the given context of the joke, as in a false analogy. On the other hand, the logic itself may be faulty and in any circumstance create only a semblance of appropriateness" [8]:140. Bearing this in mind, one should attempt to acquire those pLMs that have been relatively well documented without forcing them into prefabricated schemas as humor generations allows for.

In terms of an ontological-semantic system, introduced elsewhere in this workshop, the following adaptations need to be made to accommodate pLMs into the processing of natural language. On the one hand, a list of intentionally false inferential rules can be crafted, modeled on correct inferential rules. These will be more useful in humor generation, as they can't be assumed to cover all ways in which inference can be found to fail in humor that needs to be analyzed. One such rule that applies to the example with the explosive sex device above would be that a child concept in the ontology can inherit a property and filler from a parent concept, even if the child

concept itself has a more specific filler for that property. On the other hand, we can allow valid constraints of the ontology to not apply locally in the processing of a given sentence when that allows the instantiation of a concept marked as semantically opposite to another concept in the interpretation of the sentence. This presupposes a list of such oppositions as attributes in the ontology, but that is a separate issue, namely that of script oppositeness in the OSTH (see [11]).

Partially because of the general problem of the underspecified, undecidable, prelogical nature of the pLM sketched above, further problems arise for the knowledge engineer. While there may or may not be a textual or inferential trigger guiding the resolution process, this process takes place in a less guided fashion than incongruity identification or successful disambiguating in natural language processing of bona-fide text. Not only can we not easily identify part of the actual text as being or triggering the pLM, but can therefore often be a very different pLM for different hearers of the text.

This leads to an interesting hypothesis for humor research. As pLMs can be idiosyncratic, even more so than other processes (and results) of human language processing, they possibly account for much of the variation in humor appreciation. There are merely hints for a general, and you can find your own path to pseudo-logically connect two scripts, probably close to those that other hearers of the same text construct. But especially in nonsense, where there is little to no guidance for a playful resolution, these paths may lead in completely different directions, or a hearer may not be able to or want to find a pLM path and so finds the text not just unfunny (performance), but non-humorous (competence).

In sum, pLMs are a painful problem for the knowledge engineer who has to model them for a humor-competent natural language processing system. The reason is that their pseudo-logic is close to everyday, qualitative reasoning that resists reduction to a logical form with which its correctness could be decided, precisely because it is at the same correct and incorrect. This is compounded by the fact that current computational systems have only a very weak grasp on logics outside of blunt, unambiguous first-order logic. While terms like modal, multi-valued, abductive, paraconsistent, or fuzzy logic are being more commonly used, actual applications using these types of non-monotonic logic at a level that would be useful for humor processing do not yet exist.

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The Language of Humour

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Humour is an essential element in personal communication. While it is merely considered a way to induce amusement, humour has also a positive effect on the mental state of those using it and has the ability to improve their activity. Humour has therefore received a significant amount of attention from philosophers and researchers alike, covering fields as diverse as linguistics, psychology and philosophy. The driving force behind these investigations has been not only the hope to find an explanation for this human behaviour, but also the desire to integrate humour into practical applications that can assist with creative and motivational tasks.

Previous work in computational humour has focused mainly on the task of humour generation [7, 2], and very few attempts have been made to develop systems for automatic humour recognition [8, 4]. This is not surprising, since, from a computational perspective, humour recognition appears to be significantly more subtle and difficult than humour generation.

In this work, I explore the applicability of computational approaches to the recognition of verbally expressed humour. In particular, I investigate whether automatic classification techniques represent a viable approach to distinguish between humorous and non-humorous text, and if this distinction can be used to identify characteristics of humorous text. Using machine learning techniques applied on very large data sets, I bring empirical evidence in support of recurrent hypotheses formulated in linguistic theories of humour.

A common belief expressed by most of the linguistic theories of verbal humour [1, 5, 6] is that the key ingredients of a joke are (1) humour-specific language and (2) frame incongruity. The former factor refers to words or phrases that are typically encountered in humorous text, such as puns (“arrest” versus “rest”: “Police were called to a daycare where a three-year-old was resisting a rest.”), or stereotypes (“There are two theories about arguing with women. Neither one works.”). The second factor refers to the “surprise” interpretation that is usually associated with jokes, often obtained by using an unexpected punch line following an introductory set-up.¹ This factor has been referred to as incongruity between frames [1, 5], salient (default, familiar) versus non-salient (hidden, innovative) interpretation [3], or surprise [6].

The goal of my research to date in computational humour has been to explore on a larger scale these two main recurring hypotheses from linguistic theories of humour, by using methods from corpus linguistics. Specifically, I will present our work to find answers to the following research questions:

- 1. Can we build a very large data set of humorous text to enable corpus-based methods for humour recognition?**

One of the main requirements of methods in corpus linguistics is the availability of a large collection of texts with certain characteristics. Hence, we start by exploring the construction of very large corpora of humorous texts, which can be used to support corpus-based experiments for the recognition and analysis of humour.

¹ It is generally agreed that a joke consists of two parts: a “set-up,” which defines the context of the joke, and sets certain expectations, and a “punch line,” which is the funny part of the joke, and often violates the expectations formulated during the set-up. For instance, in “I took an IQ test and the results were negative,” the punch line “the results were negative” is unexpected and surprising, and violates the expectations of a positive IQ score formulated during the set-up.

2. Are humorous and serious texts separable, and does this property hold for different data sets?

Assuming the availability of a large collection of humorous texts, as well as a collection of structurally similar non-humorous documents, several classification experiments are run to determine if verbal humour can be automatically separated from serious text, and if this property holds for different data sets.

3. If humorous and serious texts are automatically separable, what are the distinctive features of humour, and do they hold across different data sets?

The fact that humour can be automatically separated from serious text tells us that humorous text has some distinctive features, but it does not tell us what these distinctive features are. To address this problem, a method for finding dominant classes in text is proposed, which is then used to analyse a collection of humour and determine the characteristics of verbal humour.

4. In line with the content-based features for humour recognition, can we also devise computational models to automatically detect incongruity in humour?

To address this question, the task of incongruity detection is redefined as the automatic identification of a humorous punch line among several plausible sentence endings. Several measures of semantic relatedness are explored, along with a number of joke-specific features, trying to understand their appropriateness as computational models for incongruity detection.

This is joint work with Carlo Strapparava from FBK IRST and Stephen Pulman from Oxford University.

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Why and When ‘Laughing out Loud’ in Game Playing

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INTRODUCTION

Playing games is fun. Being visible to others and knowing about others in social media is fun. Obviously, other factors are involved. We want to play games to escape from daily life, and we want to play games in order to satisfy our needs to compete and win, with other words, to prove ourselves in game situations where we are confronted with challenges that we think we can master [1].

There are video games where a single player has to deal with the game challenges. There are games where individual players compete with each other, there are multiplayer games where multiple gamers can act in teams and compete and collaborate. Playing these games is fun. Can humor contribute to fun in video games?

Human-generated humor certainly does. In Massively Multiplayer Online Role Playing Games (MMORPG) there is a meta-channel which allows players to discuss strategies, next actions, and comment on progress, et cetera, and generally a lot of event-dependent humor emerges during playing such a game. However, the humorous events are not purposely generated by the game mechanics and the game environment itself does not recognize such events. And, moreover, it are the gamers that look at events from a meta-level and providing humorous comments and jokes that transform a game event into an incongruence, while it is not actually there. Sometimes this meta-channel allows speech communication, sometimes there is text communication.

Multi-player video games are an example of generating humor evoking situations. There are many more computer-mediated and generated entertaining situations nowadays where players have to compete or to collaborate in order to achieve a certain goal. And they do not necessarily depend on network-connected keyboard and mouse (or joystick) activity only. They may take into account all kinds of verbal and nonverbal input, using all kinds of sensors that collect information from the players. This may include bodily movements, facial expressions, location information, heart rate and even brain activity. Using these input modalities in order to compete with others, for example, in an exertion game [2], does not only evoke humorous remarks and jokes of players, but also of an audience.

WHY LOOKING AT HUMOR IN GAMES?

As mentioned, in games we can think of many, naturally occurring, humor evoking situations. From a humor research point of view, accommodating and enhancing humor generation and interpretation, and producing (computing) humor seem to be rather natural issues in a game context. Games provide a wonderful test bed for all kinds of research in (natural) human-computer interaction, multi-modal and multi-party interaction, artificial intelligence, animation, computer vision, visualization, multimedia processing, virtual reality, and sensor technologies. Games do not necessarily aim at efficiency, joyful game experience (e.g., satisfaction) can be more important than reaching the highest score or winning from your virtual or human opponents in the game. Games allow a designer to play with all kinds of realistic and non-realistic events and associated input and feedback modalities. Games also provide a mass market. A new successful game product

reaches millions of users. These users are often young, interested in advanced technology (early adopters) and not afraid to spend money.

There are more recent examples of new technology that has entered the market and became extremely important because of game applications. We can mention the success of the Nintendo Wii, its sensors, and its sensor applications. Similarly, we can look at the success of the Microsoft Kinect system [3]. Again, hundred thousands or more users that not only use the product to play games that take into account body movements, but also use the Kinect computer vision technology to create games and other applications. As a third example we can look at commercial products that use brain-computer interface (BCI) technology. Originally BCI was developed for a small selected group of users that had no other opportunity to communicate with others or devices than their brain signals. When this technology was introduced for the general user, in particular the gamer [4], despite its limitations, new applications and new forms of entertainment emerged that, again, were embraced by millions of new users.

There are more examples where imperfect technology leads to very successful and commercial applications of theory and technology. The possibility to address a mass market is crucial. Hardly anyone could predict the success Wii or Kinect sensor technology and associated background theory on different types of movement recognition. No one predicted the game applications of BCI and associated developments leading to commercial BCI applications [5]. See Figure 1, which illustrates how to sell imperfect technology to measure brain activity, but, by doing so creates a market that stimulates academic research. Knowing about the effects of introducing new technology in the world of games and entertainment, a humor application may lead to results comparable with the introduction of the Wii, the Kinect, or using an EEG cap [6, 7] to issue commands to the (virtual) environment that is inhabited by the user.



Figure 1: How to make a new technology attractive for gamers

TOWARDS HUMOR USE IN HUMAN-COMPUTER INTERACTION

We can agree that in multiplayer game and multiparty entertainment situations, also when an audience is involved, humorous events are natural and humorous interpretations of events are natural. The fun we have inspires playing around with humor. As humor researchers we can try to accommodate this playing around with humor in order to increase fun. I have not seen examples of humor research that go into that direction. Apart from providing and accommodating a meta-channel that stimulates humor generation, there is the obvious question whether we can generate in-game and in-interactive entertainment humorous situations. In natural language dialogue systems attempts have been made to use knowledge of the domain and knowledge of the dialogue so far to continue a dialogue with a humorous remark [8]. A more general – but nevertheless very limited – approach has been presented by [9, 10, 11]. In these approaches, although limited, there is some appraisal of the (dialogue) environment and a decision is made of what to provide as (humorous) feedback, and how to provide it. In [12] we explored the role of embodied conversational agents (ECAs) in order to provide verbal and nonverbal feedback to humorous remarks or to generate humorous remarks. We can learn from such approaches, extending our ideas from human-human interaction in natural language and speech conversational settings, to settings that include nonverbal behavior, question-answering systems, systems that include chatbots [9, 10], embodied conversational agents [12, 13], or interaction systems that include human-like robots [14]. And not only just extending our ideas, but taking into account new modalities that help to

generate, interpret, and display richer forms of humor and appropriate feedback.

HUMOR IN GAMES AND SOCIAL MEDIA

As mentioned in the previous section, in multi-party games there is social interaction among participants. This social interaction may include audience participation. It is natural that humor will emerge in such situations. However, can we introduce the computer or its representation in an embodied agent or a humanoid robot, as a conversational partner that uses humor when communicating with others? Can we have an agent take part in a discussion on a particular game situation in a meta-channel of a multi-player game? This requires some modelling of a game situation. This may be done in a very superficial way, for example as is done in a chatbot conversational partner (Alice):

Human: I’ve had a terrible day
ALICE: What happened to it?
Human: First we were under attack
ALICE: And then what happened? And second?
Human: Then our vehicle struck a landmine
ALICE: Fascinating. It would be nice if our vehicle struck a landmine.
Human: Then my friend got killed
ALICE: Good reasoning. How well do you know this person

This is humorous, but certainly not intended to be humorous. And, what we find humorous is how the system (chatbot) acts; there certainly is no intention to hurt the feelings of someone involved in this particular situation. The example shows the difficulty of understanding a particular situation. In this example no representation of the current or previous states of knowledge are available. No ways of reasoning assuming or giving available knowledge are available. Providing some shallow interpretation to situations described above can help to improve the communication and to smooth a communication. Complete understanding of utterances or a situation is not always necessary in order to provide humorous feedback. Complete understanding of a game situation is not always necessary to generate a humorous situation or to generate a humorous remark by a game character. Nevertheless there is not much discussion on including humor in games. Dormann and Biddle [15] have a general discussion on a useful role for humor in entertainment and serious games. They have many useful suggestions for game designers but, unfortunately, the suggestions are rather general and they do not take into account that non-playing characters are not autonomous, and only take scripted decisions. Indeed, giving game characters a sense of humor would be great, but before being able to do so we need game characters that can appraise certain characteristics of a situation and then makes a decision about a humorous feedback or continuation. Although this does not seem to be impossible because state-of-the-art agent research is concerned with such issues, nowadays video games do not yet exploit such possibilities and it may be the case that quite different games need to be designed when unexpected humor is wanted.

Somers [16] mentions that “... if humor is added correctly, it can be a powerful attraction to any game.” In his paper there are suggestions about “When to add humor” and a slightly longer text about “When NOT to add humor” Citation: Players can’t blast 100 enemies if they’re too busy laughing. Again, as in the Dormann et al. [15] paper, it does not discuss humor interpretation and generation by game characters or humorous shifts in the narrative because of game events. Rather the paper talks about “adding” humor, which we associate with prepackaged jokes. Also Dan Cook [17] does not really talk about appraisal of situations that can lead to humorous feedback or continuation of the game story. However, he mentions that there are other possibilities than prepackaged jokes. Hence, “The player’s interactions with the mechanical systems of the game also can evoke laughter.” His conclusion in the paper is that games can look a lot more like friends playing a game and laughing together. This in fact suggests that existing commercial games are not well-suited for including humor. Some other papers that discuss humor in games are [18, 19].

Although interesting, in particular on creativity and game design, no suggestions on modelling humor and using such humor models in game design can be found here.

Maybe more interesting, but not directly giving directions to humor research are observations related to some humor-related clips of existing, commercial, videogames such as Octodad¹ and Portal-2².

CONCLUSIONS

Humor research gets attention. For example, well-visited on the YouTube and TED webpages are the TEDx talk on humor given by Peter McGraw [20] (see Figure 2) and the TEDWomen³ talk by Heather Knight [14]. The first talk does not bring anything new, at least when you're familiar with Bergson or Koestler on humor, but it certainly is entertaining. Rather than talking about incongruity and already existing theories of humor McGraw presents 'his' benign violation theory. In her TEDWomen talk Heather Knight introduces a stand-up-comedy-performing robot. See Figure 3.



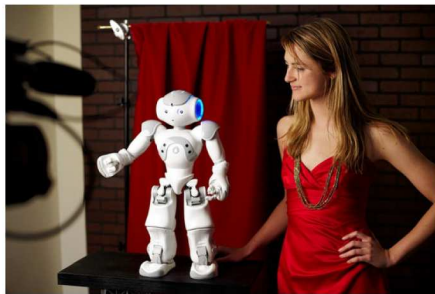
Figure 2: Peter McGraw on humor

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CREATING | Updated April 20, 2012, 6:12 p.m. ET

A Researcher and a Robot Walk Into a Bar...

By RACHEL WOLFF



Heather Knight and her joke-telling social robot Data, in Brooklyn, N.Y.

When they appear on stage, Heather Knight, a robotics graduate student, and Data, her stand-up-comedy-performing robot, seem like a futuristic Odd Couple. Ms. Knight is tall, blond and human while Data—sheathed in a white plastic shell and about a third her size—resembles a RoboCop action figure.

Figure 3: Heather Knight and her stand-up-comedy-performing robot as mentioned in The Wall Street Journal

Maybe more useful is the observation that maybe we should not start with introducing humor in the currently existing types of games. Admittedly, it would lead to a huge audience when done successfully and game companies would spend lots of R&D money when done successfully. Some years ago we visited the Blizzard Entertainment game company (World of Warcraft) with our message that game companies such as Blizzard should consider using brain-computer interfaces in addition to mouse, keyboard and joy-stick. See Figure 4.

The message was appreciated, but only several years later feedback was given. April 1, 2012 Blizzard announced a version of World of Warcraft that could be played by measuring mental

¹<http://www.youtube.com/watch?v=1VoSYDWX2Ig>

²http://www.youtube.com/watch?v=_SCnZqsJVZ8

³Microsoft Word suggests replacing TEDWomen by Taxwomen.



Figure 4: Visit to Blizzard Entertainment, Irvine, California

commands. No reason to be disappointed. It means that it is not completely impossible that a game company will consider using this input modality. And, in fact, other game companies have emerged that had no tradition in multi-player online role playing games and that introduced quite different kinds of games that needed brain activity input. Mostly these games are simple and it is difficult for the user to control the game. It means that a gamer is not necessarily confronted with a question how to kill as many enemies in a short time, but that a gamer is asked to reflect on his or her actions, to think about anticipation, and, sometimes literally, to think twice or more before really executing an action. Games that take into account such considerations can be developed and can be challenging.

Maybe a similar situation can happen when introducing humor in games. It requires a new thinking about games. Rather than thinking about “adding” humor to games, we first need to think about games that are designed to play with humor. Once such games exist and are played we can think of exporting related humor modelling to multi-player role playing games. But, of course, only when we are not sufficiently successful with humorous games that are based on models of humor. Designing games based on models of humor is a challenge for us and our PhD students.

Finally, one last issue needs to be mentioned. It is strange that humor research is conducted by old men (see Figure 5) and that this research does not, for whatever reason, attract young, creative and new researchers.



Figure 5: Panel at the 2nd International Workshop on Computational Humor. From left to right: Anton Nijholt, Cristiano Castelfranchi, Oliviero Stock, Andrew Ortony and Rachel Giora. No audience.

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Computational Humour for Creative Naming

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INTRODUCTION

A catchy, memorable and funny name is an important key to a successful business since the name provides the first image and defines the identity of the service to be promoted. A good name is able to state the area of competition and communicate the promise given to customers by evoking semantic associations. However, finding such a name is a challenging and time consuming activity, as only few words (in most cases only one or two) can be used to fulfill all these objectives at once. Besides, this task requires a good understanding of the service to be promoted, creativity and high linguistic skills to be able to play with words. Furthermore, since many new products and companies emerge every year, the naming style is continuously changing and creativity standards need to be adapted to rapidly changing requirements.

The creation of a name is both an art and a science [2]. Naming has a precise methodology and effective names do not come out of the blue. Although it might not be easy to perceive all the effort behind the naming process just based on the final output, both a training phase and a long process consisting of many iterations are certainly required for coming up with a good name.

From a practical point of view, naming agencies and branding firms, together with automatic name generators, can be considered as two alternative services that facilitate the naming process. However, while the first type is generally expensive and processing can take rather long, the current automatic generators are rather naïve in the sense that they are based on straightforward combinations of random words. Furthermore, they do not take semantic reasoning into account.

To overcome the shortcomings of these two alternative ways (i.e. naming agencies and naïve generators) that can be used for obtaining name suggestions, we propose a system which combines several linguistic resources and natural language processing (NLP) techniques to generate creative names, more specifically neologisms based on homophonic puns and metaphors. In this system, similarly to the previously mentioned generators, users are able to determine the category of the service to be promoted together with the features to be emphasized. Our improvement lies in the fact that instead of random generation, we take semantic, phonetic, lexical and morphological knowledge into consideration to automatize the naming process.

RELATED WORK

To the best of our knowledge, there is only one computational study in the literature that can be applied to the automatization of name generation. This is the acronym ironic re-analyzer and generator called HAHAcronym. This system both makes fun of existing acronyms, and produces funny acronyms that are constrained to be words of the given language by starting from concepts provided by users. HA-HAcronym is mainly based on lexical substitution via semantic field opposition, rhyme, rhythm and semantic relations such as antonyms retrieved from WordNet [6] for adjectives.

As more naïve solutions, automatic name generators (e.g. www.business-name-generators.com, www.naming.net) can be used as a source of inspiration in the brainstorming phase to get ideas for good names. A shortcoming of these kinds of automatic generators is that random generation can output so many bad suggestions and users have to be patient to find the name that they are

looking for. In addition, these generations are based on straightforward combinations of words and they do not include a mechanism to also take semantics into account.

DATASET AND ANNOTATION

In order to create a gold standard for linguistic creativity in naming, collect the common creativity devices used in the naming process and determine the suitable ones for automation, we conducted an annotation task on a dataset of 1000 brand and company names from various domains [5]. These names were compiled from a book dedicated to brand naming strategies [1] and various web resources related to creative naming such as adslogans.co.uk and brandsandtags.com.

Our list contains names which were invented via various creativity methods. While the creativity in some of these names is independent of the context and the names themselves are sufficient to realize the methods used (e.g. alliteration in *Peak Performance*, modification of one letter in Vimeo), for some of them the context information such as the description of the product or the area of the company is also necessary to fully understand the methods used. For instance, Thanks a Latte is a coffee bar name where the phonetic similarity between “lot” and “latte” (a coffee type meaning “milk” in Italian) is exploited. In addition there is a frequent use of metaphors (i.e. expressing an idea through the image of another object - e.g. Virgin) and punning (i.e. using a word in different senses or words with sound similarity to achieve specific effect such as humor - e.g. Thai Me Up for a Thai restaurant).

In order to obtain the list of creativity devices, we collected a total of 31 attributes used in the naming process from various resources including academic papers, naming agents, branding and advertisement experts.

SYSTEM DESCRIPTION

The resource that we have obtained after the annotation task provides us with a starting point to study and try to replicate the linguistic and cognitive processes behind the creation of a successful name. Accordingly, we have made a systematic attempt to replicate these processes, and implemented a system which combines methods and resources used in various areas of Natural Language Processing (NLP) to create neologisms based on homophonic puns and metaphors. While the variety of creativity devices is actually much bigger, our work can be considered as a starting point to investigate which kinds of technologies can successfully be exploited in which way to support the naming process. The task that we deal with requires: 1) reasoning of relations between entities and concepts; 2) understanding the desired properties of entities determined by users; 3) identifying semantically related terms which are also consistent with the objectives of the advertisement; 4) finding terms which are suitable metaphors for the properties that need to be emphasized; 5) reasoning about phonetic properties of words; 6) combining all this information to create natural sounding neologisms.

In computational terms, we implemented the following work flow:

- Specifying the category and properties;
- Adding common sense knowledge, using ConceptNet [3], a semantic network containing common sense, cultural and scientific knowledge;
- Adding semantically related words, exploiting WordNet [4];
- Retrieving metaphors, starting with the set of properties determined by the user and adopting a similar technique to the one proposed by [7];
- Generating neologisms, with possibly homophonic puns based on phonetic similarity;
- Checking phonetic likelihood, involving a test of the new word with a language model.

Input		Successful output		Unsuccessful output	
Category	Properties	Word	Ingredients	Word	Ingredients
bar	irishs lively wooden traditional	beertender	beertender, beer	barkplace	workplace, bar
		barty	barty, bar	barl	girl, bar
	warm hospitable friendly	giness	guiness, gin	bark	work, bar
perfume	attractive strong intoxicating	mysticious	mysterious, mystic buss	provocadeepe	provocative, deep
	unforgettable feminine mystic	bussling	buss, puzzling		
	sexy audacious provocative	mysteelious	mysterious steel		
sunglasses	cool elite though authentic	spectacools	spectacles, cool	spoleang	sporting, clean
		electacles	spectacles, elect		
	cheap sporty	polarice	polarize, ice		
restaurant	warm elegant friendly original	eatalien	italian, eat	dusta	pasta, dust
		pastarant	restaurant, pasta	hometess	hostess, home
	italian tasty cozy modern	peatza	pizza, eat		
shampoo	smooth bright soft volumizing	fragrinse	fragrance, rinse	furl	girl, fur
	hydrating quality	cleansun	cleanser, sun	sasun	satin, sun

Table 1: A selection of successful and unsuccessful neologisms generated by the model

EVALUATION

We evaluated the performance of our system with a manual annotation in which 5 annotators judged a set of neologisms along 4 dimensions: 1) appropriateness, i.e. the number of ingredients (0, 1 or 2) used to generate the neologism which are appropriate for the input; 2) pleasantness, i.e. a binary decision concerning the conformance of the neologism to the sound patterns of English; 3) humor/wittiness, i.e. a binary decision concerning the wittiness of the neologism; 4) success, i.e. an assessment of the fitness of the neologism as a name for the target category/properties (unsuccessful, neutral, successful).

Although our system is actually able to produce a limit-less number of results for a given input, we limited the number of outputs for each input to reduce the effort required for the annotation task. Therefore, we implemented a ranking mechanism which used a hybrid scoring method by giving equal weights to the language model and the normalized phonetic similarity. Among the ranked neologisms for each input, we only selected the top 20 to build the dataset. It should be noted that for some input combinations the system produced less than 20 neologisms. Accordingly, our dataset consists of a total number of 50 inputs and 943 neologisms.

Accuracy	Dimension			
	APP	PLE	HUM	SUX
micro	59.60	87.49	16.33	23.86
macro	60.76	87.01	15.86	24.18

Table 2: Accuracy of the generation process along the four dimensions.

Table 2 shows the micro and macro-average of the percentage of cases in which at least 3 annotators have labeled the ingredients as appropriate (APP), and the neologisms as pleasant (PLE), humorous (HUM) or successful (SUX). The system selects appropriate ingredients in approximately 60% of the cases, and outputs pleasant, English-sounding names in 87% of the cases.

Almost one name out of four is labeled as successful by the majority of the annotators, which we regard as a very positive result considering the difficulty of the task. In the neologisms, more than 15% of the generated names turn out to be witty or amusing. The system managed to generate at least one successful name for all 50 input categories and at least one witty name for 42. As expected, we found out that there is a very high correlation (91.56%) between the appropriateness of the ingredients and the success of the name. A successful name is also humorous in 42.67% of the cases, while 62.34% of the humorous names are labeled as successful. This finding confirms our intuition that amusing names have the potential to be very appealing to the customers. In more than 76% of the cases, a humorous name is the product of the combination of appropriate ingredients.

CONCLUSION

In this paper, we have focused on the task of automatizing the naming process and described a computational approach to generate neologisms with homophonic puns based on phonetic similarity. This study is our first step towards the systematic emulation of the various creative devices involved in the naming process by means of computational methods.

ACKNOWLEDGEMENTS

The authors were partially supported by a Google Research Award.

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Theory of Humor Computation

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There are three goals in this presentation on the theory- and rule-based approach to theoretical and computational humor. First, I want to demythologize semantics by demonstrating that it is doable and actually affordable, given the requisite know-how. Second, I want to point out the knowledge gaps in the most formal and thus computable theories of humor. And third, I want to share a perception of how rule-based and corpus-based approaches could combine for mutual benefit, thus making the world a more peaceful and greener place and Al Gore richer.

In her presentation, Julia Taylor mentions the theory-based and corpus-based approaches to computational humor. I concur that both are legitimate and, in fact, need to be combined but this paper will focus on the theory-based approach and, hence, on rule-based computation. It is clear that rules on which computation is based should include:

- semantic rules
- humor/funniness rules

Both are tall orders but in different ways. Meaning is hard to capture, and most NLP scholars give up on the enterprise considering the task of acquiring the same resources that human understanding brings to the task unmanageable and basically undoable.

What are these resources? First, the human must know and understand every word in the text. That means potentially all the different senses of a polysemous word, which is what most words are. A computational lexicon should, therefore, be compiled, and every sense of each word acquired in a machine-tractable formalism. It is, of course, possible to know a word or two somewhat approximately and complete its/their understanding with the help of other words in the sentence and/or surrounding text.

This brings up the second resource: the meanings of the words should be combined together in a sentence. This is the purview of compositional semantics, which ideally works like this: the single only possible senses of every word fit together, and the meaning of the sentence is their combination. In reality, the human figures out which of them fit together and how they fit. First, there is the syntactic structure of a sentence that regulates which words are supposed to fit. Second, each word typically has several senses, and the human has to figure out which of them fit together. In the process, the words are disambiguated in the sense of selecting the appropriate meanings for each word. There are further complications: some words are not used by themselves but rather form phrasals or idioms; other words, phrases, or sentences are used not in their literal senses; sentences express different illocutionary acts, often indirectly: thus, an order or request may be masked as a question.

All of that should be captured by a semantic analyzer that looks up each word in the lexicon and then combines them all together while disambiguating, detecting phrasals, idioms, metaphoric usages, etc. No wonder many researchers do not even try to overcome their ingrained fear of semantics induced in them by the largely non-semantic preparation in theoretical and computational linguistics and/or by the linguistic naiveté that often results from training in computer science or engineering.

But there is another even more hair-raising problem that pushes computationally-trained folks away from meaning. It is the matter of the formalism that meaning should be represented in. Simple formalisms—be it first-order predicate logic, description logic, lambda operators, feature-based

formalisms—are defeated by lexical semantics: there are too many different objects, events, and attributes. Some human dictionary—Longman’s most notably—attempt to define the meanings of words in terms of no more than a limited number of words (2,000 or so) but that makes the definitions strained and not always complete and, more importantly, it defers the matter one step: those 2000 words have to be defined in another way.

This is where an engineering computational ontology comes into the picture. Both of these adjectives are important to separate our use of ontology from the ubiquitous controlled-vocabulary taxonomies, logical ontologies as well as from philosophical and cognitive ontology. We use the ontology in our Ontological Semantic Technology as a property rich conceptual basis for the lexical senses, and it is these properties that weed out the inappropriate incompatible senses. The text meaning representations of sentences are, thus, sets of concepts interconnected by the properties with the matching fillers.

Complex as it may seem, OST is feasible and affordable, given the appropriate know-how. Understanding what is funny is much harder. Informal “theories” have abounded for centuries but they do not amount to much more than saying that some jokes may also be described as having this or that property, and all attempts to apply the universal quantifier fail. The first theory that is formal enough to serve as the basis for computing, my 1979-85 Script-based Semantic Theory of Humor (SSTH) was also double-conditional. First, it depended on a well-developed computational semantics that was not available then but is coming to shape now—hence, the transformation of the 1991 Attardo’s and my General Theory of Verbal Humor (GTVH) into Taylor’s, Hempelman’s and my 2009 Ontological Semantic Theory of Humor.

The second condition was that SSTH and its more current spinoffs can present a text only as a joke potential because none of them has accounted for the audience factor, and all stand-up comedians that the same joke may get uncontrollable laughter one night and fall flat the next at the same club. In fact, both GTVH and OSTH have an ability to accommodate the audience but have not.

The strength and weakness of SSTH was the simplicity of its basic tenet, script opposition (SO). The more refined and complex GTVH has gained no comparable popularity. Surprisingly many jokes show a simple script opposition. Not surprisingly, most jokes are not very good. The set of clear SO jokes and that of bad jokes intersects very heavily. So, what do we do with jokes that go beyond a simple SO? The answer seems simple, and I have always subscribed to this principle of Karl Popper’s, the classic of the true philosophy of science: while no number of positive examples proves a theory, one counterexample falsifies it.

Is the following a counterexample (and here I am moving dangerously but temporarily close to Taylor’s presentation)?

At the award ceremony of the 17th International Competition of Automechanics, the winner is praised by the President.

“You have shown a record-setting result. You reassembled the car engine from scratch in 35 minutes while the runner-up took over 2 hours. More amazingly, you did it all through the muffler. What do you do in life, Sir?”

“I am an MD in Ob/Gyn [Obstetrics/Gynecology].”

Where is the script opposition here? Is it between an automechanic and a gynecologist? What is funny about that? Besides it is not true to fact: nobody could assemble an engine through a tiny opening where even the doctor’s hands cannot go! Oh, but don’t they go into a pretty tiny opening, which is uncomfortably and even painfully stretched to accommodate them, in a gynecological examination? The opposition seems to be actually manifested in an unexpected similarity. One can argue quite convincingly, though, that the pretty common sex-no sex type of SO still applies: after all, it is the most obviously sexual orifice, the vagina, that is evoked, and the joke would be significantly reduced in funniness if the champion turned out to be a proctologist or an otolaryngologist. But it can be claimed that the path to this SO is not entirely simple or straightforward.

It is still orthodoxly Popperian to respond to a counterexample, real or apparent, with a refinement of a theory. The point with which I would like to conclude is that where we lack an

answer is the appropriate place for a corpus-based approach to kick in. I think it will be most useful to complement the available knowledge, not to replace it. It is also exciting to think that one day we will be able to understand what the patterns are that machine learning discovers in its better clustering results and why. I am not ready to buy into the idea that those are the patterns we are not conscious of, that they underlie our intuition or children's language acquisition, but I would surely like to know for sure.

Separating content and structure in humor appreciation: The need for a bimodal model and support from research into aesthetics

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INTRODUCTION

For a long time humor theorists have acknowledged that content and structure of humor (or: joke work vs. tendency, [4]; thematic vs. schematic, [12]; cognitive vs. orectic factors, [3]) have to be distinguished as two different sources of pleasure [6]. Nevertheless, against all evidence, taxonomies of humor are stuck in (serial) unimodal classifications rather than bi- or multimodal models. Intuitive classifications of humor typically distinguish between content classes (e.g., blonde jokes, dead baby jokes, Stalin jokes), neglecting the contributions of structural properties to appreciation of humor. Also rational taxonomies most frequently emphasize content features; e.g., when emotional features like disgust, fear or anger are highlighted in humor.

UNIMODAL, BIMODAL AND MULTIMODAL CLASSIFICATIONS OF HUMOR

Freud's [4] classification represents an interesting hybrid as he mixes content and structure in his classification of "harmless" and "tendentious" jokes; the latter being subdivided into sexual, aggressive and skeptical. He first discusses a detailed list of joke techniques (such as condensation, displacement, allusion, substitution of a trivial, absurdity, or indirect representation) to then proceed to a list of tendencies (i.e., sexual, aggressive, cynical, and skeptical themes). Harmless humor is based on joke work only, while tendentious humor allows for the gratification of repressed desires. Figure 1 shows how certain jokes (i.e., jokes 1, 2, and 3) belong to "harmless" (i.e., being based on jokes work), while others (i.e., jokes 4, 5, and 6) are classed as "sexual", still others (7, 8, and 9) as "aggressive", and others (i.e., 10, 11, and 12) are "skeptical".

However, even tendentious jokes have a structural basis (that contributes to funniness) and "harmless" jokes have contents. Thus, a bimodal taxonomy would be more appropriate, as sexual humor might be based on both condensation and displacement. Often Freud's classification seems to be understood as if content "overrides" the structure; i.e., in tendentious jokes the jokes work does not count anymore. While it is obviously an empirical question, it is likely that also in tendentious humor variations in the structure (or joke work) produces variance in perceived funniness.

The model by Ruch [7] represents half a step towards a bimodal classification. In a set of factor analytic studies it became apparent that structural properties of jokes and cartoons are at least as important as their content with incongruity-resolution (INC-RES) humor and nonsense (NON) humor consistently emerging as structural factors. The third factor was content-related, namely sexual (SEX) humor. It was apparent, that some jokes had a second loading on INC-RES or NON, while others (mostly cartoons) were relatively "pure;" i.e., exhibited only loadings on the SEX factor but not on the structural factors.

The model in Figure 2 may be criticized as not radically searching for bimodal structure. Factor analysis studies typically attempt to achieve "simple structure", i.e., to rotate the factors in a way that places each joke onto one and only one factor. However, if both content and structure are

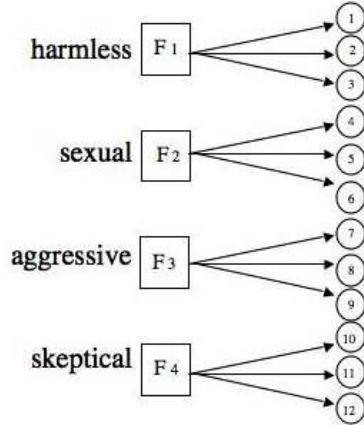


Figure 1: Freud's classification of jokes as an example of a unimodal classification of humor mixing formal (joke work) and content (tendency) features in one mode.

important, a joke should have two loadings; one on a structural factor and one on a content factor as already found for sexual humor (see Figure 2). This is not compatible with exploratory factor analytic procedures but requires either target rotations (with each joke having two assignments in the target matrix), or even better, structural equations modeling (SEM) techniques. Figure 3 represents a hypothetical bimodal structure.

Figure 3 shows how four hypothetical content factors (i.e., F1 = sexual, F2 = aggressive, F3 = scatological themes and F4 = black humor) are either based on INC-RES (i.e., F5) or NON (i.e., F6) or any other yet to be identified structural factor (i.e., F7). For example, jokes 1 to 3 are all of sexual content but joke one is based on the incongruity-resolution structure, joke 2 is a nonsense sex joke and joke 3 is based on the third structural factor. Likewise, the other content factors may be crossed with all structure factors.

To verify this model the first step should be a theoretical analysis of thematic and schematic properties of the pool of humor items to be taxonomized. In the second empirical step, jokes and cartoons of the different categories is given to a large sample that rates them for funniness. In the analysis, different structural models should be tested against each other and the one with the best fit should be retained. For example, one model might represent a unimodal taxonomy of jokes according to their content; another unimodal model might represent structural factors only. These and other models might be tested against a bimodal model that simultaneously specifies one content and one structure loading for each joke. It is expected that a bimodal model will yield the best fit. The empirically derived weights then can tell how important the postulated structural and thematic properties are for a given joke or cartoon (or clusters of jokes/cartoons). The comparison of models (with the help of goodness of fit indices) will tell whether the common practice of building unimodal classifications is appropriate or whether other assumptions (i.e., each joke is defined by both content and structure) provide a better fit to the data. One possible outcome is that for some jokes the content variance is negligible and others do not load on the structural factors. This would not be contradictory. While all jokes have a structure and a content that can be identified and analyzed by an expert, these features might be irrelevant for the everyday recipient of a joke because they may not contribute to perceived funniness. Here the difference between intuitive or rational taxonomies of humor and taxonomies based on people's responses to humor becomes most apparent.

This procedure might help with the identification of further content classes. So far the model of humor appreciation has been very parsimonious [7]. The attempt to identify the major sources of variance (leaving the minor ones aside) surprisingly did not yield content factors of sick, scatological, ethnic, or black humor; i.e., humor categories often talked about and often emphasized in

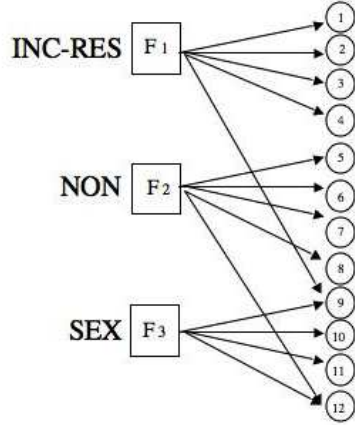


Figure 2: Results of factor analytic studies showing that INC-RES (incongruity resolution structure) and NON (nonsense structure) represent structural factors (with contents that do not produce variance) that also may load on sexual jokes and cartoons (i.e., item 9 and 14) while sexual humor also may be “pure” (i.e., have no structure contributing to funniness, as in item 10 and 11).

more intuition-based taxonomies. Confirmatory factor analysis will allow to determine how much of the variance in these putative categories is actually due to appreciation of the content and how much is due to other factors (such as structure, or lack of reliability). It seems that so far the structure variance overpowered the content variance, but a simultaneous bimodal consideration of these content categories and the structural factors would help identifying those content categories that are worth being considered further as well as the ones which can be neglected. Ideally, in such a study the jokes and cartoons sampled should stem from both structural categories.

While this procedure will allow verifying further content factors in humor, one can still expect that none of these content categories will be as salient as sexual humor. Ruch and Hehl [8] report unpublished data, where aggressive, black, and scatological humor (using jokes and cartoons based on either incongruity-resolution or nonsense) were presented in addition to jokes and cartoons without a salient content. Structure was again the more dominant factor; i.e., scatological incongruity-resolution humor correlated most strongly with other humor based on incongruity-resolution, and nonsense-based scatological humor correlated with other nonsense humor. Also, the different content categories within a structure were highly intercorrelated and not very distinct from the “harmless” category of the respective structure factor. While the study was primarily aimed at examining whether or not any of these content categories yields the salience that sexual content has, now it might be worthwhile to study whether the taxonomy can be expanded by validating further content categories. In such a study the degree of salience of the contents should be rated beforehand to be able to predict differences in the loadings on the content factor. Also, ideally parcels of homogeneous jokes (e.g., INC-RES based BLACK humor) are analyzed rather than individual jokes to enhance reliability.

The question arises whether one should not consider doing an even more courageous step into multimodal classification. For example, Attardo and Raskin [1] distinguish among six knowledge resources: language, narrative strategy, target, situation, logical mechanism, and script opposition. This suggests a six-modal taxonomy, and each joke is then coded on a vector. The question is how much variation in one parameter actually affects funniness or other perceived qualities and to what extent. Once a pool of jokes varying on all dimensions and pre-coded on these parameters is available, confirmatory factor analysis could be applied to derive empirical weights for the relevance of the different proposed modes. The failure to verify the importance of one mode (for the ordinary recipient) allows concluding that this knowledge resource does not affect differential appreciation of humor; however, it does not speak against the theoretical significance of that

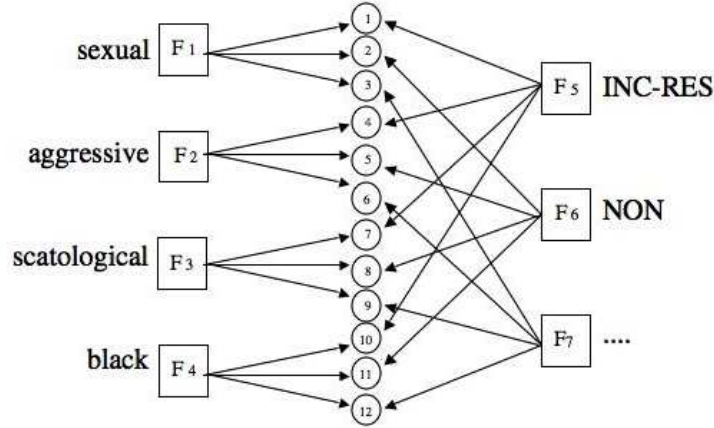


Figure 3: Simultaneous bimodal classification of humor considering variations of structure and content (INC-RES = incongruity resolution; NON = nonsense).

knowledge resource in the morphology of jokes (i.e., as a constant).

VALIDATING THE MODEL: PREDICTORS OF CONTENT AND STRUCTURE

The components of variance that may be verified by the analysis proposed above needs independent validation. Content factors, e.g., disgust humor, will allow predicting the liking of disgust themes (in humor) to general tendencies, such as the propensity to experience disgust. It can be predicted that, for example, only the content variance in aggressive INC-RES humor will relate to the persons level of aggressiveness but not the variance due to appreciation of the INC-RES structure. Ruch and Hehl [8] demonstrated this for liking of sexual humor where an index of liking of the structure of sexual humor correlated with appreciation of the respective structure category. Furthermore, the liking of the sexual content related to general tendencies like sexual libido and satisfaction.

There is ample evidence that the structural dimensions in humor transcend the field of humor and actually are relevant in other aesthetic domains. In a variety of studies [9, 10, 11] correlations between liking of structural factors in humor and liking of visual art, literature and music were found. Hypotheses were based on the definitions of the structural factors as well as the ideas of the new experimental aesthetics [2]. In detail, it has been proposed, that jokes and cartoons of the INC-RES humor category are characterized by punch lines in which the surprising incongruity can be completely resolved. The common element in this type of humor is that the recipient first discovers an incongruity which is then fully resolvable upon consideration of information available elsewhere in the joke or cartoon. Although individuals might differ with respect to how they perceive and/or resolve the incongruity, they have the sense of having “gotten the point” or understood the joke once resolution information has been identified [5]. It seems that resolving the incongruity is the key element and this led to the idea that reducing uncertainty (i.e., preferring redundancy) is the rewarding element in this form of humor.

Nonsense humor also has a surprising or incongruous punch line, but “... the punch line may 1) provide no resolution at all, 2) provide a partial resolution (leaving an essential part of the incongruity unresolved), or 3) actually create new absurdities or incongruities” [5]:124. In nonsense humor the resolution information gives the appearance of making sense out of incongruities without actually doing so. The notion of unresolved incongruity in nonsense should not been mistaken as “not comprehensible”. People who successfully process nonsense humor know that they have “gotten” what there is to get. They enjoy the play with absurd ideas, the contrast of sense and nonsense; it is not that they enjoy which they did not understand. Both the incongruity-resolution and the nonsense structure can be the basis for harmless as well as tendentious content (e.g., sexual

humor). The common element in this form of humor is that some people apparently enjoy the residual incongruity. This led to the idea that nonsense humor is an indicator of liking uncertainty (in the information theory sense) in general; i.e., of liking of asymmetry, complexity, novelty, incongruity, or novelty.

Indeed, individuals appreciating INC-RES humor liked, for example, photographs of art paintings rated as simple and representational, liked simple hand drawings (e.g., a square or rectangle), and liked sounds clips of music of the categories R & B, country, and pop. At a more global level they are characterized by intolerance of ambiguity, conservatism, closedness to new experience etc. Individuals appreciating NON humor liked, for example, photographs of art paintings rated by experts as complex and fantastic, liked complex hand drawings, complex polygons, literature classified as high in grotesqueness, and liked music clips of the categories of jazz, progressive rock, Indie-rock and new music. Furthermore, they also produced more complex matrix patterns and enhanced visual incongruity when given the opportunity [9, 10, 11]. At a more global level, these people were also higher in experience seeking, imaginativeness and openness to experience. As it is not so much of interest how much one likes, for example, INC-RES or NON humor but how the appreciation of NON is relative to INC-RES, difference scores were computed that reflect the relative preference of nonsense over incongruity resolution. Such structure preference scores acknowledge that humor and music are different fields of the aesthetic and they suggest that the relevant variance is the relative preference rather than absolute liking. Indeed, preference of NON over INC-RES, for example, correlated .27 with preferring complexity over simplicity in music [11].

In sum, the present contribution strongly advocates for the separation of structure and content in humor appreciation, and that structural and content features in jokes and cartoons will be differently predicted by ecological and collative variables [2]. Using modern structural equation modeling (SEM) approaches it will be possible to identify further content factors or even other factors proposed by other theoretical approaches [1, 6]. It should be highlighted that we talk about ingredients that actually matter to the naive recipient—not what seems to be of interest to the sophisticated researcher of a special discipline.

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Creativity and Computational Humor

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TOWARDS A ROADMAP FOR HUMOR RESEARCH

In *The Act of Creation* [5], Arthur Koestler devotes a good deal of attention to humor, identified as one of the highest expressions of human creativity.

Creativity is a fundamental attribute of the human species. Yet, currently the increase of computer capabilities is offering the possibility of challenging the uniqueness of that attribution. Take for instance the case of chess: while in general the layman attributes the successful performance of the computer to its tremendous memory and speed, nowadays chess grandmasters see it differently. A common statement of theirs is that the most striking property of a computer program like Junior, the current computer chess world champion, when playing against human grandmasters, is its creativity [2].

Especially in Europe and to some degree in Japan, there is a new awareness that an important challenge for the future of ICT is creativity. So I believe it is important to view computational humor as an area that should be approached with a prospect of automated creativity (see also Ritchie [7]).

Margaret Boden [1] has observed there are three ways in which creativity is realized: by combination, by exploration and by transformation. The first one produces unfamiliar combination of familiar ideas. An example is analogy. Exploratory creativity is based on some space of thinking, well defined, for instance through generative rules; the space is explored, both looking for previously unreached places and, in abstract, with an aim to understand the potential and limits of the space. Transformational creativity is when the space itself is transformed by altering some of its dimensions. So, ideas are generated that could not be generated before the transformation.

While the proposed types of creativity have different degrees of difficulty, what are the main factors that make computational creativity a realistic endeavor? Progress in artificial intelligence is one factor that favors the development of creative programs. Progress has been continuous, even if no extraordinary breakthrough has occurred or is likely to occur. Another very important factor is recent availability of great quantity of resources, such as texts, images, recordings, videos etc. and ways of fast processing of this material. Yet another factor is the acquisition of some better understanding of the relation between human creativity and the computer role. Specifically then, with the emergence of social computing (in various declinations), we have much better means for approaching creativity as a social process, involving humans and machines. At the same time cognitive science, and more indirectly cognitive neuroscience are offering incremental understanding of the creativity phenomena, and while the second one is yielding initial results it may possibly lead to significant breakthroughs in the next couple of decades.

Creativity in computer systems has an enormous potential at least in these areas:

- Automatic discovery of abstract concepts or of hidden characteristics of an artifact
- Automatic creation of concepts and artifacts
- Semiautomatic collaborative human-computer creation
- Automatic appreciation and evaluation of creative production

Of the many specific themes in which these areas can be realized, here I would like to emphasize two:

1. Language creativity (including novel attractive evaluative expressions, humor, narratives, poetry)
2. Socially based creativity (examples: group creative processes based on mental states of participants, common ground and exceptional novel step in the collective thinking)

The most appealing prospect for me is related to the intervention on humans, be it by persuading (influencing creatively the adoption of beliefs, attitudes and behaviors), or by yielding through creativity an aesthetically relevant outcome. A fundamental concept is that in both cases in principle this should be done by assessing the context, modeling the internal state of the target humans, and adapting the intervention. In addition, an assessment of the effect of the creative message can close the loop.

From the applied point of view there is important potential for art, entertainment, and all forms of persuasive technologies. I think the overall impact on human potential, and in particular augmenting the capability of seeing things from novel points of view has an enormous strategic value for development.

I believe there will be a strong impact on society on the overall ethical dimension (creativity leads to more creativity, critical thinking and social expression). But also important is the fact that ICT-based creativity will lead to robust developments of businesses based on automated creativity with as targets at least the following: learning, society – both public and enterprise, entertainment and art, advertising.

Now, what can we say in concrete for computational humor? The four areas mentioned above as domains for the realization of creativity are all relevant for computational humor. They can be instantiated as:

- Automatic discovery of humor
- Automatic creation of humor expressions
- Semiautomatic collaborative human-computer creation of humor
- Automatic appreciation and evaluation of humor production

probably the most difficult one being the last one.

In Hulstijn and Nijholt [4] and Stock, Strapparava and Nijholt [9] a panorama of the field as it emerged from participated workshops was provided, respectively for the Mid Nineties and the beginning of the new century; a few other assessments have been produced. Now is the time to take the opportunity for proposing, in the context of the new attention to creativity, themes for development in computational humor for the coming few years. Some initial considerations follow.

Theory: The first reference theory for computational humor [6] has bootstrapped the field and led to valuable subsequent refinements; now especially theories are needed that describe the creative process, and from the computational side are appropriate for accommodating the opportunities we have now, for instance relating novelty with revisitation of known material.

Evaluation: A very important aspect, instrumental for many realizations is (human) evaluation of human behavior, for instance personality studies to assess different attitudes toward forms of humor, and also evaluation of the effectiveness of automatic realizations. It can be noted that crowdsourcing techniques may amplify greatly the feasibility of experimental studies. Probably studies involving neuroscience and brain-computer interaction will take longer to yield useful results.

Humor Production: Many aspects of humor production can be studied combining top down rule-based approaches, which model general strategies, and the wealth of possibilities that come from learning from corpora. Creativity realized in many forms of simple verbal humor is a realistic challenge for the near future.

Recognizing humor/Understanding humor: Recognition of simple forms of humor is realistic and has been achieved in some cases. Some limited forms of understanding humor, and possibly assess the humorous effectiveness may also be possible in the next few years.

Multimodality and new forms of humor: Most interest in the community has been devoted to verbal humor, mostly written. Multimodality should become a new focused theme. And novel kind of forms of humor may possibly be introduced with the potential provided by new devices that bring about novel forms of multimodal interaction.

Sociality: As already Freud [3] noted, a key element for humor success is deciding when the situation is appropriate for humorous interventions. So far very little has been done from a computational point of view. Yet the experience gathered in understanding people behavior - and notably group behavior - in an instrumented environment can now be shifted toward understanding if the context is favorable and the effects of humor are those expected.

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OSTH at Work – Lessons Learned; Hopes Intact*

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There are three goals in this presentation on the theory- and rule-based approach to theoretical and computational humor. First, I want to demythologize semantics by demonstrating that it is doable and actually affordable, given the requisite know-
The paper pursues the issue of whether SSTH/GTVH/OSTH-type humor theory is ready to underlie computational humor and tentatively concludes that it should be refined further first.

With the advancement of computational technologies, increasingly more emphasis continues to be placed on systems that can handle natural language, whether it involves human-computer communication, comprehension of written narratives, of information on the Web, or of human conversations. Humor is a necessary part of all verbal communication. Thus, without humor detection, no natural language computer system can be considered successful: it is necessary for full computational understanding of natural language documents and for enabling intelligent conversational agents to handle humor.

In the last couple of years, more and more work has been done on computational detection of humor, both from theory-based and corpus-based points of view. It can be argued that both approaches are equally valuable: often enough, people identify that something is a joke (whether humorous or not) without being able to tell why it is so, thus somewhat undermining – granted, only for a particular individual – a formula “text T is a joke if and only if it has X, Y and Z as its components.” This suggests that for computational purposes, at least two methodologies have to be tried: one that decides whether T is a joke based on some independent (theoretical) criteria and another that decides whether T is a joke based on its comparison to a known joke T’—on unknown criteria.

One of the better known linguistic theories of humor that address joke analysis and, hence, comparison – and since we are talking about text we should consider linguistic theories first, perhaps supplemented by others – is the General Theory of Verbal Humor (GTVH). The theory compares jokes in terms of six knowledge resources: Script Overlap/ Oppositeness, which comes from the Script-based Semantic Theory of Humor (SSTH); Logical Mechanism; Situation; Target; Narrative Strategy and Language. GTVH subscribes to the same premise as SSTH in that a text is humorous if it is compatible fully or in part with two scripts that overlap and oppose. While script overlap has been described, neither GTVH nor SSTH stated what it actually means for scripts to oppose. Hempelmann proposes to treat oppositeness as “situational, contextual, or local antonyms,” thus moving the question by one level: what does it mean for two scripts to be situational or contextual antonyms? Which part of the script should be looked at for such determination?

Taylor proposed to look at the goals, results, and effects (or paths to them) of the scripts, and showed experimentally that such admittedly approximate representation worked well on short children’s jokes. Further analysis of the jokes from Raskin’s SSTH book shows that roughly 80% of script oppositeness in the jokes listed in the book can be described in terms of these proposed metrics. An example of a joke that did not quite work is below:

An aristocratic lady hired a new chauffeur. As they started out on their first drive, she inquired: “What is your name?” “Thomas, ma’am,” he answered. “What is your last name?” she said. “I

*This work should be treated as an extended abstract, thus all references are omitted.

never call chauffeurs by their first names.” ”Darling, ma’am,” he replied. ”Drive on – Thomas,” she said.

While the goal/result approach is good enough for a first try in computational implementation, it is hardly good enough for the underpinnings of a theoretical enterprise.

At this point, it is helpful to remember that SSTH was supposed to be based on a solid computational semantic framework, thus the Ontological Semantic Theory of Humor was created, based on Ontological Semantics and Ontological Semantic Technology (OST). The goal of OST is to represent any text in a text-meaning representation (TMR) ontology-based formalism that removes unnecessary ambiguity but preserves vagueness and imprecision of natural language, which is how people understand that text. Such representation is suitable for computational “understanding” – since the most troubling parts for the machine are removed. It should be noted that if a sentence has several interpretations, several TMRs would be created, thus a sentence “A man walks into a bar” will result in (at least) two (simplified) TMRs, one representing a man walking into a drinking establishment and another of a man colliding with a horizontal pole:

TMR1: walk(agent(person(gender(male))(age(adult))))(location(bar))
 TMR2: collide(agent(person(gender(male))(age(adult))))(theme(pole))(instr(leg))

Using the same logic, a high-level representation can be created for the following joke:

Andy is going on a blind date but is worried that she may turn out to be ugly. A friend advises him to scream and fake a heart attack then. The date turns out to be sexy and beautiful, but she suddenly screams “aaaauuhhh,” clutches her chest and falls to the ground.

The representation can be sketched below (see figure 1), where each blue box shows an event (underlined) with properties and fillers that describe it, and each box is connected with some properties, making some events fillers of the properties of the higher-level events in the TMRs.

An interesting question is, then, whether we can compare texts that are similar to this sketch (relative to events, properties, fillers) and conclude that they are jokes, based on the GTHV parameters. Ideally, texts that we conclude to be jokes are funny to people.

Let us consider 5 versions of the same joke:

1. Danny sets up Andy to go on a blind date with Shirley, a friend of a friend of his. But Andy is a little worried about going out with someone he has never seen before. “What do I do if she’s ugly?” says Andy, “I’ll be stuck with her all night.” ”Don’t worry.” Danny says. ”Just go up to her door and meet her first. If you like what you see, then everything goes as planned. If you don’t, just shout Aaaaauuggghhh! clutch your chest and fake a heart attack.” So that night, Andy knocks on Shirley’s door, and when she comes out he is awe-struck with how beautiful and sexy she is. Andy’s about to speak when the girl suddenly shouts, “Aaaaauuggghhh!”, clutches her chest and falls to the ground. (132 words)
2. Sam didn’t want to go on the blind date that Tom had arranged for him. “What if she’s really ugly and I hate her?” he complained. “Then just clutch your chest and fake a heart attack” Tom replied. Sam thought this was a good idea, so he agreed to go through with it. He went to the address Tom had given him, and a beautiful woman answered the door. “Hi, I’m your blind date!” Sam said. The woman clutched her chest and fell to the ground. (87 words)
3. Andy is going on a blind date but is worried that she may turn out to be ugly. A friend advises him to fake a heart attack then. The date turns out to be beautiful and sexy, but she suddenly clutches her chest and falls to the ground. (49 words)
4. Andy is going on a blind date. He asks a friend, “What do I do if she’s ugly?” The friend advises him, “If you don’t like what you see, just clutch your chest and fake a heart attack.” The date turns out to be beautiful and sexy, but she suddenly clutches her chest and falls to the ground. (59 words)

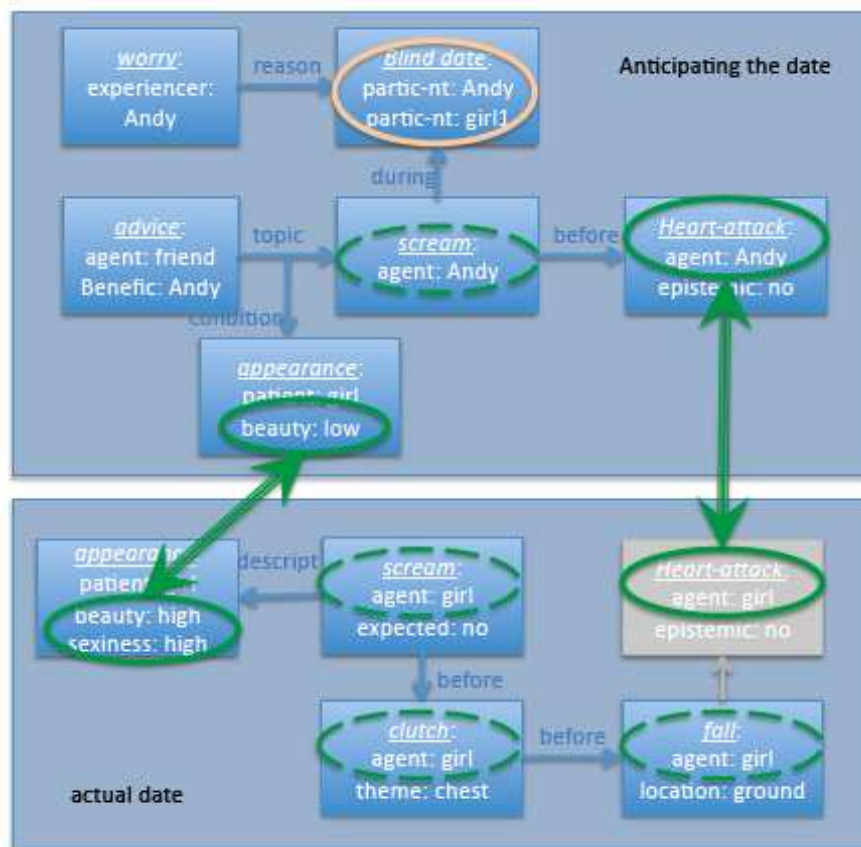


Figure 1: High-level Representation of a joke

5. Andy is going on a blind date but is worried that she may turn out to be ugly. A friend of both advises him to scream and fake a heart attack if he doesn't want to stay for a long time. When Andy comes to the provided address, the date turns out to be beautiful and sexy, but she suddenly screams "aaaauuhhh," clutches her chest and falls to the ground. (71 words)

These jokes can be compared with GTVH, as shown below:

	Joke 1	Joke 2	Joke 3	Joke 4	Joke 5
SO	real/non-real				
LM	reversal				
SI	blind date				
TA	n/a				
NS	dialog	dialog	no dialog	dialog	no dialog
LA					

An experiment was conducted in Amazon’s Mechanical Turk/Purdue Qualtrix environment, and the participants were asked to rate the funniness (0 to 4) of 5 different versions of 10 different jokes, with one of the jokes, with its 5 versions, exemplified above. The following ratings were obtained (a control question was used to verify that the subject was paying attention to the questions and that no bots were used in the completion of the study).

	Joke 1	Joke 2	Joke 3	Joke 4	Joke 5
mean	3.31	3.24	2.79	2.89	2.77
st dev	1.16	1.18	1.42	1.28	1.27
median	4.00	3.00	3.00	3.00	3.00
n	26	29	38	53	39

An obvious question to be asked is why these variants of jokes receive such ratings and whether there is some semantic foundation for it. One explanation could be that a short joke creates a small enough space for the two scripts to fire, and the SO is not realized. Another explanation could be that a narrative strategy without a dialog does not work for this particular joke. A sketch of various events in all 5 variants is shown in the diagram below (figure 2). The colorful strips above each event indicate whether or not this event was used in the version (orange stands for joke 1, azure for joke 2, green for joke 3, red for joke 4, violet for joke 5). White rectangle instead of a colored one indicates that a particular event was not used.

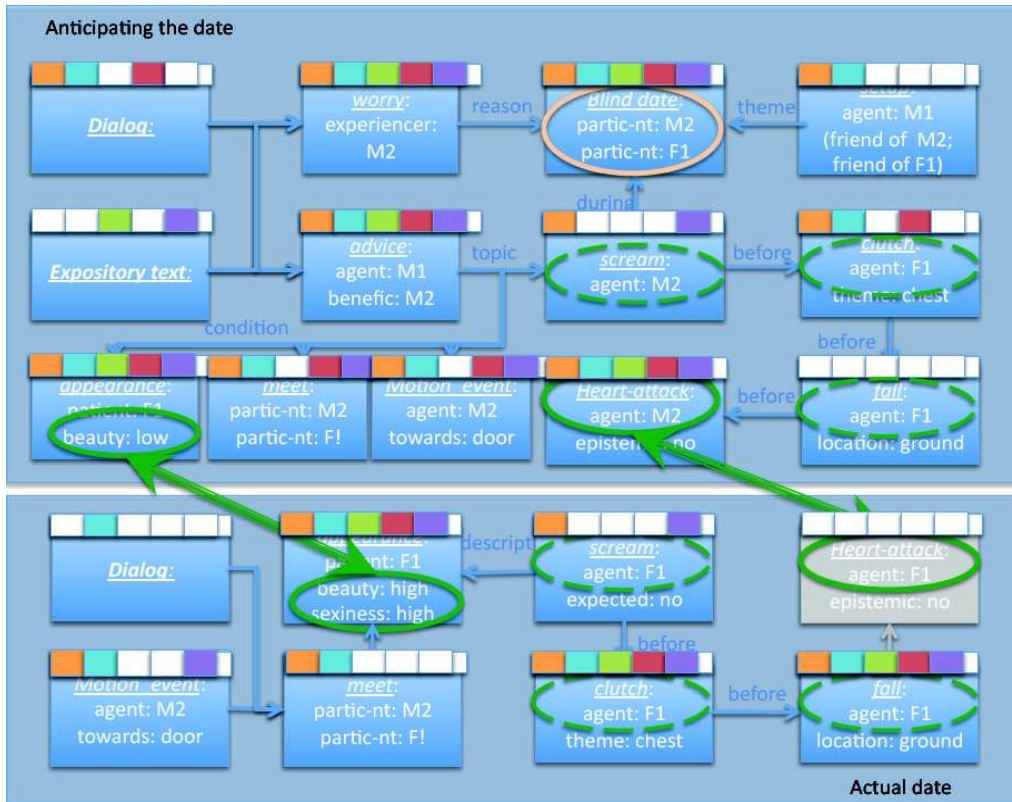


Figure 2: Sketch of various events in all 5 variants

Interestingly, while every joke setup indicated that a man was to fake a heart attack, not a single variant of the punch line spelled out that the girl was “having” it, thus leaving the resolution peace for the audience to work out. Jokes 3 and 5 are inconsistent in their usage of clutching one’s chest – the punch line uses it without its being prepared for (or primed) by the setup. On the other hand, not a single setup mentions that a man should fall, but every punch line uses the girl

falling to the ground. This may suggest that the strongly primed events (heart attack → fall) don't have to be mentioned in the setup before activated by the punch line, but weakly primed or non-salient events should be made explicit in the setup if they are to be used in jokes with the reversal Logical Mechanism. Narrative Strategy seems to be correlated with the funniness of the joke, as suggested earlier. Also interestingly, the greater length of the joke contributes to the explicit verbalization of such events as setting up a blind date by a friend or coming to the door of the girl's house, thus somewhat enhancing the blind date event. It is not clear if the length itself would play any beneficial role for this SO and LM if instead of enhancing the main scripts, it would describe, for example, participants of the events in great detail.

Last but not least, there is a clear overlap and oppositeness demonstrated in the diagram. The scripts are roughly called anticipating the date and actual date (or actual vs. non-actual) and, of course, they have goals attached to it. Accidentally, this joke is a perfect example of when the goals of the two scripts completely oppose from the point of view of a man that went on a date. This demonstrates that it is possible to use OSTH as an extension of the GTHV. Moreover, OSTH provides a way of looking at a joke in a finer grain size.

Analysis of 5 variants of 9 more jokes will be sketched at the talk.

The experiment, limited as it is, seems to support an a priori reasonable conclusion that the existing linguistic theories of humor, going through its development phases, while not necessarily literally computable as is, should be refined further to provide an adequate basis for computational humor. If no such refinement works, the corpus-based methodology should have the freedom of the domain.

Creative Coding for Humor Design: A Preliminary Exploration

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INTRODUCTION

Computational humor generation is a tricky problem. The idea to have a computer program capable of making people laugh, in a similar way today machines can beat them at chess, is intriguing. Unfortunately the prototypes built in the last decade do not seem to have exhibited humorous skills comparable to those of humans.

There are several factors contributing to the limitations in the current state of the art. First, good humor requires a large amount of common sense and linguistic knowledge. It is necessary for modeling (and then violating) people's expectations and inducing surprise, or for representing ridiculous or embarrassing events in an indirect and original way. Moreover, humor is a creative process. Most of jokes seem to be based on a linguistic invention or the discovery of a new funny association. For instance, the capability to quickly discover humorous associations is crucial in specific contexts, as in the case of the appropriateness of a witty remark during a conversation. Creativity provides humor with a dynamic dimension and a second order of complexity. Finally, the fruit of the creative discovery become part of the collective knowledge and can be reused as a cultural object.

These problems might be sufficient to discourage any significant advancement. Nevertheless there is another area of computer technology in which the above issues seem to be addressed in an unexpected way. It is named with different terms such as generative art or creative coding. Both humor and art aims are creative and complex processes, and both aim to induce an emotional effect (mirth in the former case, aesthetic pleasure in the latter one). In recent years a number of programming languages and computational environment for creative coding have been developed and have attracted a growing community of artists and enthusiasts.

This contribution is a small collection of observations emerged during an explorative study of these environments, performed during the last months. It is aimed to search new ideas and methodological directions for the future development of research in computational humor generation.

THE KNOWLEDGE HOME

A few years ago the artificial life theorist Tommaso Toffoli proposed his vision of a Knowledge Home, a possible computational knowledge environment used as an extension of human mind [3]. While resembling Dawkins' notion of "extended phenotype" [1], this metaphor emphasizes the role of knowledge sharing and reuse as a way to produce culture.

In less than one decade, a large part of this vision seems to have become real. Social networks, cloud computing, wikis, and smartphone apps are only a few examples of the multiplicity of innovations that are dramatically changing the nature of social relationships and allowing people to produce new forms of culture. In this transformation an important role is played by the new way to look at programming languages. They are not only associated to their syntax and semantics but also to the libraries developed and made available over the years. Java is a typical example of

this change of perspective. Due to its high portability and suitability for Internet programming, it is continuously enriched by new packages, which are then included in the official distributions.

CREATIVE CODING AND GENERATIVE ART

A further step in the evolution of the computational cultural environments appears to be the recent development of environments for creative coding. This term is generally indicating the use of computer programming for building digital artworks, such as images, animations, and interactive multimodal objects. At present there are several projects of this nature, the most di used of which is Processing [2]. It is a scripting language and a development environment built upon Java and widely used by artists, students, and researchers¹.

A key feature of this language is the simplification of instructions for defining and visualizing graphical objects. The project website allows programmers to make their code available to other users. The artworks can be executed online as Java applets and are sorted and shown in the homepage according to the users' rates. In this way, the programs (called sketches) are easily executed and reused to build more complex artifacts.

BUILDING BLOCKS FOR THE HUMOROUS ENVIRONMENT

The observational exploration of the environments for digital art and visual design are proposed as a form of inspiration to shape the future of computational humor generation. In particular, two elements are identified here as having a crucial role in the transformation of a computational environment in a cultural engine supported by active communities: knowledge sharing and reuse.

In a recent work, a first tentative step was taken in order to integrate different computational humor tools [4]. A lexical resource consisting of a collection of ambiguous lexical item was collected and then used as source for the production of three types of humorous puns: punning riddles, funny acronyms and variation of familiar expressions via lexical replacement. In a more general creative and humor-oriented environment, a community of designer would add new types of humorous strategies and integrate new computational linguistic resources.

It is worthwhile to observe that, in the case of creative coding environments, the contribution of human creativity is not necessarily a limitation for the development of artworks based on completely automatic forms of machine creativity. For instance, a good number of interactive animations are implemented exploiting Artificial Intelligence models such as swarm particle optimization or cellular automata. The humorous environment could be exploited as a test bed for the exploration of new wordplays or the discovery of new humorous semantic associations.

The next step in the development of a computational humor environment would be the design of a scripting language not only capable to exploit the available resources, but also appealing enough to motivate users to play and perform new forms of creative coding.

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¹Other interesting analogous projects are Nodebox, developed in Python, and Cinder, built in C++.

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